

## WHAT IS CLAIMED IS:

1. A voice communication device, comprising:

a control CPU for outputting a speaker amplification value corresponding to volume on a speaker which is adjusted by a terminal user by using a volume control unit; and

an echo processing unit for reducing an echo equivalent to output voice, which is obtained by amplifying a received input signal demodulated and voice-decoded according to the speaker amplification value output from the control CPU and outputting the received input signal from the speaker and is mixed with a transmitting input signal input through a microphone, according to the speaker amplification value.

2. A voice communication device according to claim 1, wherein the echo processing unit comprises echo canceling means for calculating a pseudo echo from both the received input signal amplified according to a degree of the change of the speaker amplification value and a filter coefficient calculated according to an acoustic transmission characteristic between the microphone and the speaker, and removing the echo from the transmitting input signal including the echo by using the pseudo echo.

3. A voice communication device according to claim 1, wherein the echo processing unit comprises echo canceling means for changing a filter coefficient, which is calculated according to an acoustic transmission characteristic between the microphone and the speaker, according to a degree of the change of the speaker amplification value, calculating a pseudo echo from both the received input signal and the filter coefficient, and removing the echo from the transmitting input signal including the echo by using the pseudo echo.

4. A voice communication device according to claim 3, wherein the filter coefficient is changed stage by stage by the echo canceling means in a case where the degree of the change of the speaker amplification value is larger than a prescribed degree of the change.

5. A voice communication device according to claim 3, wherein the filter coefficient is set to zero or a value near to zero by the echo canceling means in a case where the degree of the change of the speaker amplification value is larger than a prescribed degree of the change.

6. A voice communication device according to claim 3, wherein the filter coefficient is changed by the echo canceling means in a case where the degree of the change of the speaker amplification value is larger than a prescribed degree of the change within a prescribed time period.

7. A voice communication device according to claim 1, wherein the echo processing unit comprises echo canceling means for calculating a pseudo echo from both the received input signal and the filter coefficient calculated according to an acoustic transmission characteristic between the microphone and the speaker, changing the pseudo echo according to the speaker amplification value, and removing the echo from the transmitting input signal including the echo by using the changed pseudo echo.

8. A voice communication device according to claim 2, wherein the pseudo echo is set to zero or a value near to zero by the echo canceling means in a case where the speaker amplification value is larger than a prescribed threshold value.

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9. A voice communication device according to claim 2, wherein the pseudo echo is attenuated by a prescribed value by the echo canceling means in a case where the speaker amplification value is larger than  
5 a prescribed threshold value.

10. A voice communication device according to claim 2, wherein the pseudo echo, which is calculated according to the filter coefficient calculated before the speaker amplification value becomes larger than  
10 a prescribed threshold value, is used by the echo canceling means to remove the echo from the transmitting input signal in a case where the speaker amplification value is larger than the prescribed threshold value.

11. A voice communication device according to claim 1, wherein the echo processing unit comprises double talk detecting means for altering a judgment criterion for double talk detection according to a degree of the change of the speaker amplification value and detecting a double talk according to the altered judgment criterion, and echo  
15 canceling means for calculating a pseudo echo from a filter coefficient calculated according to an acoustic transmission characteristic between the microphone and the speaker, removing the echo from the transmitting input signal including the echo by using the pseudo echo, and performing a renewal stop or a renewal start of the filter  
20 coefficient according to a detection result of the double talk  
25 detecting means.

12. A voice communication device according to claim 1, wherein the echo processing unit comprises double talk detecting means for  
30 altering a judgment criterion for double talk detection according to

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a degree of the change of the speaker amplification value and detecting a double talk according to the altered judgment criterion, echo canceling means for reducing an echo component of the transmitting input signal by using a pseudo echo and producing a residual signal, and echo suppressing means for suppressing the residual signal produced by the echo canceling means at an attenuation value which changes according to a detection result of the double talk detecting means.

10 13. A voice communication device according to claim 11 or claim 12, wherein the double talk is detected by the double talk detecting means according to the comparison of a power of the transmitting input signal with a power of the residual signal, and the judgment criterion for double talk detection is altered by the double talk detecting means by changing a weighting factor, by which the power of the transmitting input signal is multiplied, according to the degree of the change of the speaker amplification value.

SUB A1 20 14. A voice communication device according to any of claims 1 to 10, wherein the echo processing unit comprises echo suppressing means for suppressing the transmitting input signal including the echo at an attenuation value corresponding to the speaker amplification value output from the control CPU.

SUB A2 25 15. A voice communication device according to any of claims 1 to 14, wherein the echo processing unit is formed of a digital signal processor.

16. An echo processing processor, comprising:  
30 a received signal input port for receiving a received input signal

including voice information;

a speaker amplification value input port for receiving a speaker amplification value corresponding to volume which is adjusted by using a volume control unit;

5 a transmitting signal input port for receiving a transmitting input signal including voice given by a terminal user; and

an echo reduction processing unit for performing an echo reduction process in which an echo equivalent to output voice, which is obtained by amplifying the received input signal received in the received signal  
10 input port according to the speaker amplification value received in the speaker amplification value input port and outputting the received input signal from a speaker and is mixed with the transmitting input signal received in the transmitting signal input port, is reduced according to the speaker amplification value.

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17. An echo processing processor according to claim 16, wherein an amplification process for amplifying the received input signal received in the received signal input port according to a degree of the change of the speaker amplification value received in the speaker  
20 amplification value input port, a filter coefficient calculating process for calculating the filter coefficient according to an acoustic transmission characteristic between a microphone and the speaker, a pseudo echo calculating process for calculating a pseudo echo from the filter coefficient calculated in the filter coefficient  
25 calculating process and the received input signal amplified in the amplification process and an echo canceling process for removing the echo from the received input signal by using the pseudo echo are performed in the echo reduction processing unit.

30 18. An echo processing processor according to claim 16, wherein a

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filter coefficient calculating process for calculating the filter coefficient according to an acoustic transmission characteristic between a microphone and the speaker, a pseudo echo calculating process for changing the filter coefficient calculated in the filter

5 coefficient calculating process according to a degree of the change of the speaker amplification value received in the speaker amplification value input port and calculating a pseudo echo from both the filter coefficient and the received input signal received in the received signal input port and an echo canceling process for removing  
10 the echo from the received input signal by using the pseudo echo are performed in the echo reduction processing unit.

19. An echo processing processor according to claim 18, wherein the filter coefficient is changed stage by stage in the pseudo echo  
15 calculating process performed in the echo reduction processing unit in a case where the degree of the change of the speaker amplification value is larger than a prescribed degree of the change.

20. An echo processing processor according to claim 18, wherein the  
20 filter coefficient is set to zero or a value near to zero in the pseudo echo calculating process performed in the echo reduction processing unit in a case where the degree of the change of the speaker amplification value is larger than a prescribed degree of the change.

21. An echo processing processor according to claim 18, wherein the  
25 filter coefficient is changed in the pseudo echo calculating process performed in the echo reduction processing unit in a case where the degree of the change of the speaker amplification value is larger than a prescribed degree of the change within a prescribed time period.

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22. An echo processing processor according to claim 16, wherein a filter coefficient calculating process for calculating the filter coefficient according to an acoustic transmission characteristic between a microphone and the speaker, a pseudo echo calculating process  
5 for calculating a pseudo echo from both the filter coefficient calculated in the filter coefficient calculating process and the received input signal received in the received signal input port and an echo canceling process for changing the pseudo echo calculated in the pseudo echo calculating process according to the speaker  
10 amplification value received in the speaker amplification value input port and removing the echo from the received input signal by using the changed pseudo echo are performed in the echo reduction processing unit.

23. An echo processing processor according to claim 16, wherein the pseudo echo is calculated according to the filter coefficient, which is calculated before the speaker amplification value becomes larger than a prescribed threshold value, in the pseudo echo calculating process performed in the echo reduction processing unit in a case where  
20 the speaker amplification value is larger than the prescribed threshold value.

24. An echo processing processor according to claim 16, wherein a double talk detecting process for altering a judgment criterion for  
25 double talk detection according to a degree of the change of the speaker amplification value and detecting a double talk according to the altered judgment criterion, a filter coefficient calculating process for calculating the filter coefficient according to an acoustic transmission characteristic between a microphone and the speaker and  
30 performing a renewal stop or a renewal start of the filter coefficient

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according to a double talk judgment result of the double talk detecting process, a pseudo echo calculating process for calculating a pseudo echo from both the filter coefficient calculated in the filter coefficient calculating process and the received input signal received in the received signal input port and an echo canceling process for removing the echo from the received input signal by using the pseudo echo are performed in the echo reduction processing unit.

25. An echo processing processor according to claim 16, wherein a double talk detecting process for altering a judgment criterion for double talk detection according to a degree of the change of the speaker amplification value and detecting a double talk according to the altered judgment criterion, an echo canceling process for reducing an echo component of the transmitting input signal by using a pseudo echo and producing a residual signal and an echo suppressing process for suppressing the residual signal at an attenuation value which changes according to a detection result of the double talk detecting process are performed in the echo reduction processing unit.

26. An echo processing processor according to any of claims 16 to 25, wherein an echo suppressing process for suppressing the transmitting input signal including the echo at an attenuation value corresponding to the speaker amplification value is performed in the echo reduction processing unit.

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